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Science and Art Gossip.

IT seems likely that we shall soon hear of serious volcanic outbursts in the Italian region of subterranean activity. At Cassone, Verona, and Brescia earthquakes have been felt and houses thrown down.

PROFESSOR C. W. C. FUCHS announces that the total number of recorded earthquakes for the year 1881 is 297, volcanic eruptions numbering 10,—the most important being that of Mauna Loa, in Hawaii.

"PRESENT evidence," says Prof. Owen, in *Longman's Magazine*, "concurs in concluding that the modes of life and grades of thought of the men who have left evidences of their existence at the earliest periods, hitherto discovered and determined, were such as are now observable in 'savages,' or the human races which are commonly so called."

M. BERGERON, a French scientist, has produced a miniature imitation of the craters in the moon by sending a current of hot air through a brass tube into a mass of melted, but gradually cooling, metallic alloy. M. Bergeron looks upon the experiment as suggesting the manner in which the lunar craters may have been formed.

THE French Minister of Marine has appointed a commission to investigate and report upon a new arrangement for illuminating submarine operations. A powerful arc lamp is enclosed in a water-tight casing, the bottom of which is formed of a glass plate, and the top is provided with a reflector that will distribute the light over a circle about 100 ft. in diameter. The series of experiments, which it is intended shall be very complete, will be conducted at Marseilles. The divers will be in telephonic connection with the surface, and be able to direct the movements of the lamp, which will be suspended over the operations, and can be shifted at will.

THE *Nautical Gazette* says that during the year 1881 the vessels lost at sea averaged about one every four hours. A large proportion of these losses occurred from carelessness, and mostly in fogs and other darkness. There were 400 ocean steamer collisions in 1879 and 1880 in the North Atlantic Ocean alone. Each of these might have been avoided if the master of one colliding vessel had been informed in proper time of the course pursued by the approaching one. These losses gave an average of over one steamer a day in which human life was sacrificed and valuable property destroyed. The *Gazette* believes that if a system of fog-signals had been in use, such as the Barker code, nearly all of these disasters would have been prevented or avoided.

LIEUT. HOVGAARD, in a letter to Herr Gamel, the projector of the Danish Polar Exhibition, states that the *Dijmphna* is frozen in near Novaia Zemlia; but he hoped to get free during the equinoctial gales and reach the Jenisei. All well on board.

REASON is not always heard in vain. The Temperate House Gate to Kew Gardens, which was being bricked up so resolutely, is to be unbricked again, and restored to its former condition. It is pleasant to be assured that this is being done "with the full concurrence of Sir Joseph Hooker;" yet he must not take it ill if we address our thanks more pointedly to Mr. Shaw-Lefevre.

IT should in fairness be added that this is not absolutely the first time that Sir Joseph Hooker has been known to give "his full concurrence" to a desirable measure. For a long time the members of the Kew Fire Brigade sought in vain for permission to erect a station and engine-room on the borders of his territories. But they "went about with him." They persuaded a son of this local magnate to become a captain in the Fire Brigade, and he, in turn, persuaded his father to allow a small portion of his park to be used for the erection of a Fire Brigade station. These potentates must be deftly dealt with.

WE have spoken of the blowing up of casual trees in Kew Gardens. Sometimes the work of destruction goes on so actively that one might imagine a siege was in progress. It is very necessary that many of the trees, when they show signs of decay, should be removed. Other trees are saved, and the Gardens are in many cases improved. Hundreds of tons of wood have thus been disposed of. This wood was, one would say, the property of the nation—not worth very much, perhaps—yet if Sir Joseph had had it sold, however, and the proceeds given to the poor or to his gardeners, no one would have complained, we think. He found another use for it, however. *It made splendid bonfires.*

ACCORDING to Professor F. C. Phillips, healthy plants may absorb through their roots small quantities of lead, zinc, copper, and arsenic. The lead and zinc may enter the tissues in this way without harming the plants, but the compounds of copper and arsenic exert a distinctly poisonous influence—tending to kill the plants when present in the soil in considerable quantities.

AN astronomical observatory has lately been erected by the Italian Government on Mount Etna, above Catania, which is the highest inhabited building in Europe, as it beats the St. Bernard Hospice by over 1,000 feet. It has two stories with spacious balconies, and has been built on a cone near the summit of the mountain. The observatory

will not be touched by any eruptions, as the lava always flows down on the further side of the volcano.

Several Russian Physicians have been making researches as to the prevalence of colour-blindness in that country. Women are found less subject to it than men. Out of 10,828 railway servants examined, no less than 251 were colour-blind, and 32 proved to have an imperfect capacity for distinguishing colours, making the average percentage of colour-blind 2·6. Experiments on sailors and pupils in naval schools disclosed a much higher percentage—6·08 per cent. of colour-blind, and 8·5 with imperfect vision.

The *New York Herald* office was lighted on the night of Sept. 4 last by the Edison system, which has been in successful use ever since, the total number of lamps in the installation being 642, distributed as follows:—In the engine and boiler-room, 9; press-room, 98; folding-room, 41; stereotype department, 40; machine-shop, 90; telegram office, 9; counting-room, 51; library, 60; office and private rooms, 17; composing and editorial rooms, 86; main composing-room, 196; halls and passage, 18; and reflector for illuminating bulletin board outside building, 13. The current is conveyed from the dynamos (K type) from the machine-room to the *Herald* building through 400 ft. of conductors laid in a tube. The Edison Company is about to light the American Sound Boat *Pilgrim* with 802 incandescent lamps.

Sydney, New South Wales, is to have in its lighthouse an electric light, the merging beam of which is to possess a luminous intensity of more than 12,000,000 candles.

A crisis in the Italian coral trade is reported imminent. This is due to the remarkable productivity of the new coral banks discovered two years ago at Sciaccia, on the north-west coast of Sicily. So great has been the output of a second-grade coral that last year one-half of the exports of Naples, which were valued in all at about 7,500,000 dols., consisted of coral. Most of this was sent to British India, in spite of the fact that that market was overstocked. Coral, both in Italy and India, has therefore become a drug in the market, and will not bring the holders cost price.

The method of cleaning brass which is in use at all the United States arsenals is claimed to be the best in the world. The plan is to make a mixture of one part common nitric acid and one-half part sulphuric acid in a stone jar, having also ready a pail of fresh water and a box of sawdust. The articles to be treated are dipped into the acid, then removed into the water, and finally rubbed with sawdust. This immediately changes them to a brilliant colour. If the brass has become greasy it is first dipped in a strong solution of potash and soda in warm water. This cuts the grease, so that the acid has free power to act.

A frog was found frozen in the middle of a 250 pound cake of ice at New London, Conn., a few days ago, but after lying for a few moments in a pail of water, it showed signs of life, and was soon very lively. The ice in which the frog was imprisoned was cut last February, so that it must have been frozen for nearly seven months.

The *Coal Trade Journal* (New York, Sept. 27) says that the largest vein of coal in the world has recently been discovered in what was the Ute Indian Reservation, in Colorado. It comprises 1,600 acres of land; the coal is semi-bituminous and of jet black colour, is said to be of excellent quality and almost free from sulphur. It will smelt iron without coking, having been used by the miners in the neighbourhood for dressing their steel drills, and pronounced by them superior to charcoal for the purpose. Three railroads are completed within a few miles, so that there is no want of transport.

MM. Egasse, Mangin, and Cloris-Baudet, of Paris, have recently conducted some interesting experiments having for their object the development of a system of night signalling by means of small captive balloons, to which are attached incandescent lamps. The balloon experimented upon was about 7 ft. in diameter, and was made of translucent impermeable paper filled with hydrogen. Within it, and suspended from the top, was a Swan lamp. The balloon was allowed to ascend, and when in the air the current was passed through the lamp, the effect being to illuminate the paper sphere to such an extent as to allow it to be visible for a very considerable distance. By suitable connections, a system of Morse signalling may be established, and messages transmitted at night with great facility. Of course, the foe must be requested not to read the messages, but turn his head the other way.

With last number the first year of Knowledge closed, though the second volume will not be completed till the end of 1882. As some evidence that we have dealt fairly with our readers and subscribers (and perhaps rather more than fairly), we note that three volumes of articles reprinted from Knowledge are now nearly ready for issue—namely, "Nature Studies" and "Leisure Readings," by Messrs. Grant Allen, Andrew Wilson, Edward Clodd, A. C. Ranyard, Thomas Foster, and the Editor; and "The Stars in their Seasons" (the monthly Star-maps, with notes, by the Editor). The price of these three books (6s., 6s., and 5s. respectively) is almost exactly double the yearly price of Knowledge. Besides these works, a large portion of the Editor's work on the Great Pyramid (published by Messrs. Chatto & Windus) is taken, with the illustrations, from the pages of Knowledge, as are some of the most interesting papers in Mr. Mattieu Williams's new work, "Science in Short Chapters"; while the Publishers of Knowledge have not reprinted papers by Dr. Carpenter, Miss A. B. Edwards, Dr. Ball, Mr. Slack, and other writers, which have appeared in Knowledge during the past year. Adding to these the continued articles on Electricity, Athletics, Butterflies and Moths, Flowers of the Month, and other subjects, Reviews (by divers writers), Gossip, Extracts, Notes, Correspondence, Queries and Replies, Mathematics, Chess, and Whist, it must be admitted, we think, that we have given readers a fair return for their weekly two-pence.

In the coming months we propose to do better still. Several subscribers note, not grumblingly but suggestively, that continued articles appear at too long intervals, or irregularly. This will be corrected. We have arranged for series of papers by Messrs. Grant Allen, E. Clodd, and others, whose names and subjects will presently be announced, each series being continued, at intervals not exceeding a fortnight; for weekly notes on astronomical phenomena observable during each coming week; and for other new features of interest and value which our growing experience, or the hints of valued correspondents have suggested. We believe our readers will admit that Knowledge grows from more to more, in interest, as well as in other ways.

A PROBLEM IN ATOMIC PHYSICS.

By Prof. J. Tyndall.

WE must refresh ourselves by occasional contact with the solid ground of experiment, and an interesting problem now lies before us awaiting experimental solution. Suppose 200 men to be scattered equably throughout the length of Pall Mall. By timely swerving now and then, a runner from St. James's Palace to the Athenæum Club might be able to get through such a crowd without much hindrance. But supposing the men to close up so as to form a dense file crossing Pall Mall from north to south: such a barrier might seriously impede, or entirely stop, the runner. Instead of a crowd of men, let us imagine a column of molecules under small pressure, thus resembling the sparsely distributed crowd. Let us suppose the column to shorten, without change in the quantity of matter, until the molecules are so squeezed together as to resemble the closed file across Pall Mall. During these changes of density would the action of the molecules upon a beam of heat passing among them at all resemble the action of the crowd upon the runner?

We must answer this question by direct experiment. To form our molecular crowd we place, in the first instance, a gas or vapour in a tube 38 in. long, the ends of which are closed with circular windows, air-tight, but formed of a substance which offers little or no obstruction to the calorific waves. Calling the measured value of a heat-beam passing through this tube 100, we carefully determine the proportionate part of this total absorbed by the molecules in the tube. We then gather precisely the same number of molecules into a column 10·8 in. long, the one column being thus three and a half times the length of the other. In this case also we determine the quantity of radiant heat absorbed. By the depression of a barometric column, we can easily and exactly measure out the proper quantities of the gaseous body. It is obvious that one mercury inch of vapour, in the long tube, would represent precisely the same amount of matter—or, in other words, the same number of molecules—as $3\frac{1}{2}$ in. in the short one; while 2 in. of vapour in the long tube would be equivalent to 7 in. in the short one.

The experiments have been made with the vapours of two very volatile liquids—namely, sulphuric ether and hydride of amyl. The sources of radiant heat were, in some cases, an incandescent lime cylinder, and in others a spiral of platinum wire, heated to bright redness by an electric current. One or two of the measurements will suffice for the purposes of illustration. First, then, as regards the lime light. For 1 inch of pressure in the long tube, the absorption was 18·4 per cent. of the total beam; while for 3·5 inches of pressure in the short tube, the absorption was 18·8 per cent., or almost exactly the same as the former. For 2 inches pressure, moreover, in the long tube, the absorption was 25·7 per cent.; while for 7 inches, in the short tube, it was 25·6 per cent. of the total beam. Thus closely do the absorptions in the two cases run together—thus emphatically do the molecules assert their individuality. As long as their number is unaltered, their action on radiant heat is unchanged. Passing from the lime-light to the incandescent spiral, the absorptions of the smaller equivalent quantities in the two tubes were 23·5 and 23·4 per cent.; while the absorptions of the larger equivalent quantities were 32·1 and 32·6 per cent. respectively. This constancy of absorption, when the density of a gas or vapour is varied, I have called "the conservation of molecular action."

But it may be urged that the change of density, in these experiments, has not been carried far enough to justify the enunciation of a law of molecular physics. The condensation into less than one-third of the space does not, it may be said, quite represent the close file of men across Pall Mall. Let us therefore push matters to extremes, and continue the condensation till the vapour has been squeezed into a liquid. To the pure change of density we shall then have added the change in the state of aggregation. The experiments here are more easily described than executed; nevertheless, by sufficient training, scrupulous accuracy, and minute attention to details, success may be ensured. Knowing the respective specific gravities, it is easy, by calculation, to determine the condensation requisite to reduce a column of vapour of definite density and length to a layer of liquid of definite thickness. Let the vapour, for example, be that of sulphuric ether, and let it be introduced into our 38-in. tube till a pressure of 7·2 in. of mercury is obtained. Or let it be hydride of amyl, of the same length, and at a pressure of 6·6 in. Supposing the column to shorten, the vapour would become proportionally denser, and would, in each case, end in the production of a layer of liquid exactly 1 millimètre in thickness.* Conversely, a layer of liquid ether, or of hydride of amyl, of this thickness, were its molecules freed from the thrall of cohesion, would form a column of vapour 38 inches long, at a pressure of 7·2 inches in the one case, and of 6·6 inches in the other. In passing through the liquid layer, a beam of heat encounters the same number of molecules as in passing through the vapour layer, and our problem is to decide, by experiment, whether in both cases the molecule is not the dominant factor, or whether its power is augmented, diminished, or otherwise overridden by the state of aggregation.

Using the sources of heat before mentioned, and employing diathermanous lenses, or silvered mirrors, to render the rays from those sources parallel, the absorption of radiant heat was determined, first for the liquid layer, and then for its equivalent vaporous layer. As before, a representative experiment or two will suffice for illustration. When the substance was sulphuric ether, and the source of radiant heat an incandescent platinum spiral, the absorption by the column of vapour was found to be 66·7 per cent. of the total beam. The absorption of the equivalent liquid layer was next determined, and found to be 67·2 per cent. Liquid and vapour, therefore, differed from each other only 0·5 per cent.; in other words, they were practically identical in their action. The radiation from the lime-light has a greater power of penetration through transparent substances than that from the spiral. In the emission from both of these sources we have a mixture of obscure and luminous rays; but the ratio of the latter to the former, in the lime-light, is greater than in the spiral; and, as the very meaning of transparency is perviousness to the luminous rays, the emission in which these rays are predominant must pass most freely through transparent substances. Increased transmission implies diminished absorption, and, accordingly, the respective absorptions of either vapour and liquid ether, when the limelight was used, instead of being 66·7 and 67·2 per cent., were found to be—

Vapour	33·3 per cent.
Liquid	33·3 „

no difference whatever being observed between the two states of aggregation. This same was found true of hydride of amyl.

This constancy and continuity of the action exerted on the waves of heat when the state of aggregation is changed,

* The millimètre is $\frac{1}{25}$th of an inch.

I have called "the thermal continuity of liquids and vapours." It is, I think, the strongest illustration hitherto adduced of the conservation of molecular action.—*Longman's Magazine.*

THE COMET.

By R. A. Proctor.

(*Continued from page* 355.)

THE illustrations which we give this week speak for themselves, and will serve better than any verbal description to show what the Comet is doing at present, where it is going, and what it looked like when last well seen in this country.

In the first place, we give a map (Fig. 1) showing the course of the Comet among the stars during the present month.

The map has been formed from a section of one of the twelve maps of my "Library Star Atlas." The direction of the tail is such as to correspond to the direction of a great circle towards the point on the star-sphere opposite to the position of the sun's centre.

But this map, being taken from a star-atlas, is not calculated to show the position which the comet will have upon the *sky*, as distinguished from the star-sphere, especially as the region athwart which the comet is at present travelling is not rich in conspicuous stars. (The star α Hydræ, the nearest third magnitude star, see Figs. 2 and 3, is called Alphard, or the solitary one.)

We might refer those of our readers who possess Parts IV. and V., or the numbers for Feb. 3 and March 3 (14 and 18) to the star-maps corresponding to the hours between which the comet will be best seen in November; for those maps, which are for 10 p.m. on Feb. 6 and March 8 respectively, show the aspect of the heavens two hours later, or at midnight on Jan. 7 and Feb. 6 respectively; two hours later still on Dec. 7 and Jan. 7 respectively; two hours later, or at 4 a.m. on Nov. 6 and Dec. 7 respectively; and thus the second of them (that given in No. 18) shows the aspect of the heavens at 6 a.m. on Nov. 6. We have them in the maps for February and March, at 10 p.m., the aspect of the heavens at 4 a.m., and at 6 a.m. on Nov. 6; and readers who possess these maps can at once turn to them to see whereabouts the stars shown in Fig. 1 are at these hours; whence, of course, their position at any intervening time can be at once inferred, the motion being slight in the interval. On Nov. 11 the maps show the aspect of the heavens from 3.45 a.m. to 5.45 a.m.; and so on, earlier by a quarter of an hour for each four days (about); until on Dec. 6 we have the second map showing the heavens for 4 a.m., but still serving to indicate the aspect of the star sphere to later hours, because the diurnal motion of the heavens in the part where the comet is, lies in the morning hours nearly parallel to the horizon.

But, as many of our present readers do not possess these earlier star-maps, we have thought it well to give sections, showing those parts of the sky where the comet is in the early morning hours. All that we have just said applies to Figs. 2 and 3.*

In fig. 4 I give a picture of the comet formed after careful study of seventeen pictures which have reached me from as many correspondents. None of these (and some score of others, who have described without picturing the

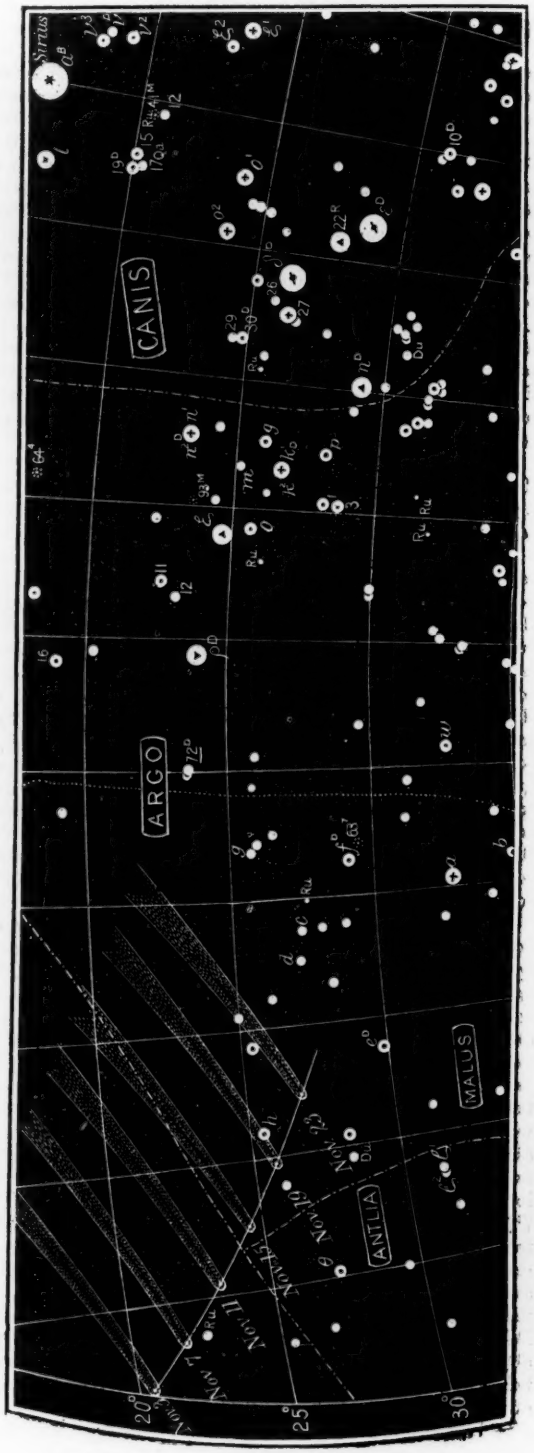


Fig. 1. Course of the Comet during November.

comet) seem to have noticed the marked form of the lower fork of the tail, as described by Major John Herschel;

* I may notice in passing that possibly this illustrative case may give many a better idea of the way in which the monthly maps are meant to be used, than they have hitherto had. In republishing them, I am adding a table showing the times *all through the night* at which the maps can be used.

but as he used a binocular, and gave some time to the study of the comet's appearance, the peculiarity was doubtless correctly indicated by him. I have not felt justified, however, in doing more than slightly strengthen the delineation of this southern fork, as shown in three of the pictures sent me. I have not thought it well to send several of the pictures to the engraver, simply because the result would have been bewildering to those who have not yet seen the comet. On the other hand, I could not select any single picture. It seemed to me that a picture formed by showing only those features which at least five of the observers depict, and also others who have sent drawings to other periodicals, would give a more correct idea of the comet's real aspect than six or seven discordant drawings.

40° *above Horizon.*

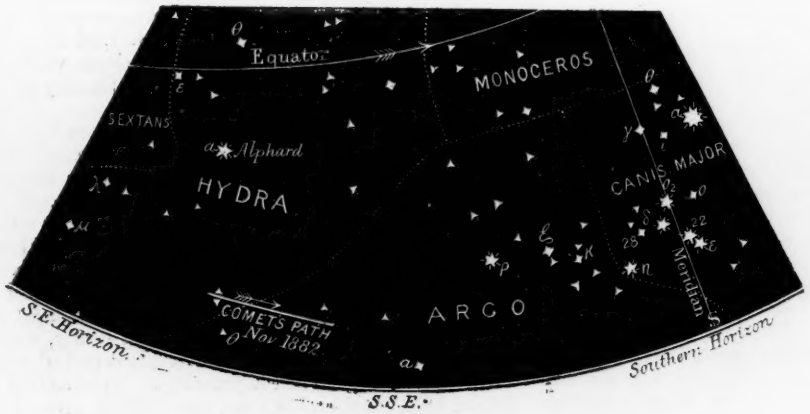


Fig. 2. Showing the path of the Comet in November, the stars being as seen :—

On Nov. 6, at 4 a.m.
Nov. 10, at 3.45 a.m.
Nov. 14, at 3.30 a.m.
Nov. 18, at 3.15 a.m.
Nov. 21, at 3 a.m.
Nov. 25, at 3.45 a.m.
Nov. 29, at 3.30 a.m.
Dec. 2, at 3.15 a.m.

40° *above Horizon.*

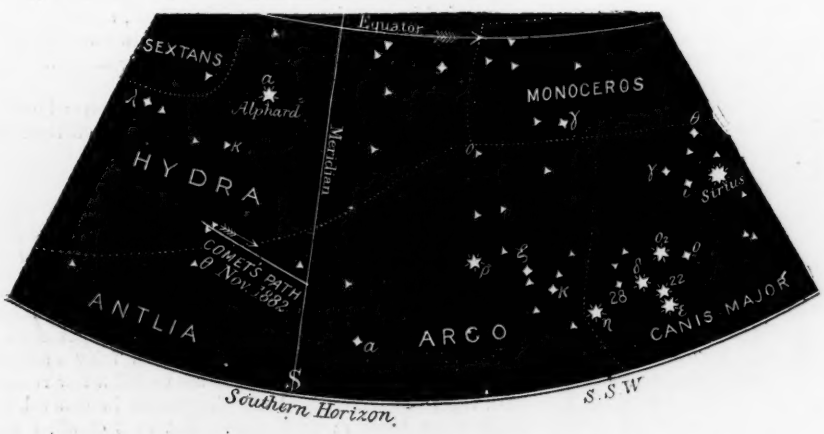


Fig. 3. Showing the path of the Comet in November, the stars being as seen :—

On Nov. 6, at 6 a.m.
Nov. 10, at 5.45 a.m.
Nov. 14, at 5.30 a.m.
Nov. 18, at 5.15 a.m.
Nov. 21, at 3 a.m.
Nov. 25, at 3.45 a.m.
Nov. 29, at 3.30 a.m.
Dec. 2, at 3.15 a.m.

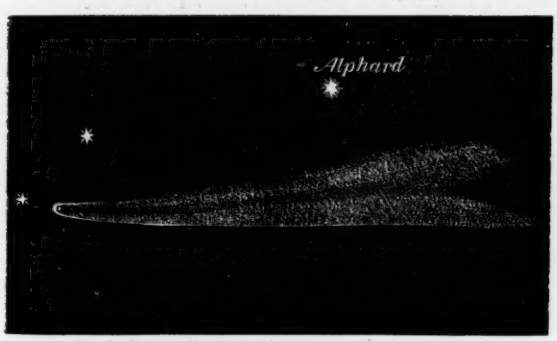


Fig. 4. Great Comet of 1882, as seen Oct. 23, 5 A.M.

I may note that those observers are in error who regard the dark streak behind the nucleus as the shadow of the latter. Whatever this characteristic feature of so many comets may be, it is not *that.*

EARTHQUAKES IN THE BRITISH ISLES.—II.

(*Continued from page* 341.)

AFTER the great shock of 1275, more than a century passed without any remarkable earthquakes. In 1382 a shock took place by which several churches in the south-east of England were thrown down, and this was, we believe, the last earthquake by which property of any consequence was destroyed.

In recent times, earthquakes have taken place with tolerable frequency in the British Isles. In fact, of the three hundred earthquakes recorded as having disturbed our country, nearly two-thirds belong to the present century.

XUM

If we run over the period which has elapsed since 1755 we shall find sufficient evidence of the distinctness with which earthquake shocks have made themselves felt in England. We select that year because the whole of the country was then shaken by the effects of the great earthquake at Lisbon. It was at a little past nine that Lisbon was destroyed, and very soon after—so soon, indeed, that it was at first considered that the shocks took place at the same moment—a variety of singular forms of disturbance were experienced in different parts of England, Scotland, and Ireland. It would occupy much more space than we can here spare to record all the remarkable events related respecting the share our country had in the great earth tremor which spread outwards on every side from the centre of disturbance in 1755. But a few of the more striking will not fail, we think, to prove interesting to our readers.

At Barlborough, in Derbyshire, a surprising and terrible noise was heard on the western side of a large body of water called Pibley Dam, which is said to have covered at least 30 acres of land; then a great swelling wave of water came in from the south, and rose two feet on the sloped dam-head at the north end of the water. The wave subsided, but presently returned again. And the agitation continued, with gradually decreasing violence, for three-quarters of an hour.

At a place in Surrey called Busbridge there was a canal about seven hundred feet long and fifty-eight feet broad. At the eastern end of this canal the water, at the hour we have named, was observed to be in a great state of turmoil and agitation. The surface of the water, instead of being level, was seen to be ridged like the roof of a house, only rounded at the top. This ridge extended lengthwise about thirty yards, and stood about three feet above the usual level of the water. After oscillating for a few moments, this heaped-up water swept suddenly towards the northern bank of the canal, and poured over the grass-walk on that side. It then returned and swept with still greater force over the grass-walk along the southern bank. It was noticed that the bottom of the canal was left dry for several feet when the water swept towards the south. The flux and reflux of the water in the canal continued for upwards of a quarter of an hour, during which the sand of the bottom was thrown up and thoroughly mixed with the water, which continued turbid long after the disturbance had ceased. During the whole time of the movement, a noise was heard (as if beneath the ground) resembling the noise of water turning a large mill.

At Eyam-bridge, in Derbyshire, the overseer of the lead-mines felt a sudden shock which raised him violently from the ground in his chair. The plaster of the room fell all around him. The roof was so violently and visibly shaken that he imagined the engine-shaft had fallen in. When he ran out to inquire about the supposed accident, he found that those who had been at work underground had experienced yet more singular effects. Two miners who were employed in drawing the ore along the drifts of the mines were shaken so violently that for awhile they were too terrified to move. They were afraid to climb up the shaft, as they believed that it was beginning to fall in upon them. While they were consulting what should be done to secure themselves from this danger, a second shock more violent than the first frightened them so much that they ran precipitately to the other end of the drift. Then they climbed down to another miner who worked twelve yards below them. He told them that the second shock had been so violent that he had seen the rocks around grinding upon one another. While he was talking a third shock came, which was accompanied by a loud rumbling noise in the bowels of the earth. Presently another shock followed, and five minutes after a fifth. The most violent of all, however, was the second, a circumstance which corresponded in a remarkable manner with the extreme violence of the second shock experienced at Lisbon. A reference to the narrative of this catastrophe in the essay on earthquakes in "The Borderland of Science" (Vol. I. of *Knowledge Library*), will show that it was this shock which had the principal part in the destruction of the city and its inhabitants.

At Shireburn Castle, in Oxfordshire, there is a moat which encompasses the building. On the morning of the earthquake the air was calm and loaded with a somewhat heavy fog. The water of the moat was as smooth as a looking-glass. Suddenly one corner of the moat was observed to be disturbed in a singular manner. While all the rest of the water maintained its smoothness unchanged, this part began to flow backwards and forwards in a surprising manner. The flux and reflux were observed to be quite regular. Each flow of water began gently, then its violence increased by degrees, and at last it rushed in upon the shore with wonderful impetuosity. This motion continued for a considerable time, and excited great amazement amongst those who witnessed it, since they were quite unable to account in any way for so mysterious and persistent a commotion.

At Loch Lomond, the waters of the lake suddenly rose upon its banks, and that to so great a height that a boat was carried in one place forty yards inland, and there left. In five minutes more the water rose again as rapidly as before, and again receded. This peculiar motion lasted for more than an hour.

During the same great earthquake, women who were washing on the banks of the Tay were swept off their feet by a wave.

(To be continued.)

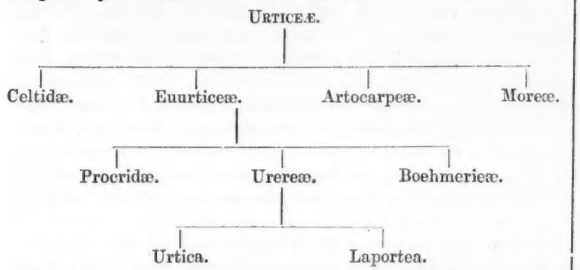
STINGING-TREES.

IN KNOWLEDGE of Sept. 15, page 256, there appeared a paragraph on "The Stinging-Tree" of Queensland, Australia. As that most interesting colony possesses at least three perfectly distinct plants, each fully deserving that title, it may not be amiss for me to add a few remarks with regard to Queensland stinging-plants in general, and these three trees in particular. But first of all, I must take exception to some of the statements made by "A Traveller," quoted in the paragraph to which I have referred. I used for many years to shoot in scrubs in both North and South Queensland, and during that time I was stung, not "only once, and that very lightly," like the "Traveller," but times without number, and often very severely; but, unlike him, I was never "warned of its close proximity by its smell." A friend of mine, who has had considerable experience in Australian scrubs, writes:—"The stinging-plants have no notable smell, and certainly none that would attract attention. The trees are usually isolated."

I have noticed that upon very close examination, especially if the leaves be bruised, a faint, unpleasant odour may be detected, but this is in no case sufficient to attract attention in a scrub. Again, the stinging-trees are always, so far as my experience goes, more or less isolated, and never form anything approaching to the "little forest" mentioned by the "Traveller." *Urtica incisa*, however, is said to cover almost completely one island in the Fitzroy River, and grows in great profusion in that neighbourhood, but it can never in any sense of the word be called a tree.

The sting produces in most cases a small white mark, which soon disappears, and, if on the hand, the pain, which is excruciating, gradually extends from the affected spot up the arm, till it reaches the axilla, where it often becomes very intense. Its duration varies from half an hour to several hours, and even when the pain has ceased, the slightest touch to the affected spot, or, above all, the application of cold water, will renew the pain.

In considering the stinging-plants of Queensland, we need only, for our present purpose, deal with the natural order *Urticeæ*, and of the seventeen genera of that order, found in Australia, we are most concerned with the two—*Urtica* and *Laportea*. Their relation to the sub-tribes and tribes of the order is shown in the following table, which I have constructed in accordance with the classification adopted by Bentham and Von Mueller.



Of the genus *Urtica* there are two species in Queensland, both herbaceous plants:—

1. *Urtica incisa*, found chiefly on the Fitzroy river, and said by M. Thozet, of Rockhampton, to grow in great profusion.

2. *Urtica Urens*, a common weed in this country, and found in the neighbourhood of dwellings in Queensland.

In the genus *Laportea* we have, on the other hand, the three great stinging-trees to which I have referred. They are:—

1. *Laportea gigas*, a large tree, often attaining a height of 100 ft. or more; but I have not myself seen any specimens over 80 ft. The wood is soft, fibrous, and juicy, and the bark smooth and ash-coloured. The base of the tree is supported by prominent angles or buttresses. The leaves are from 1 ft. to 1 ft. 6 in. long, and nearly as broad, smooth above and sprinkled with a few stinging hairs, but more or less covered with short, soft hairs underneath. It is found chiefly in South Queensland. The sting is severe, but, as far as my experience goes, not so bad as that of *L. moroides*.

2. *Laportea photiniphylla*.—A fine tree, from 60 to 70 feet in height, with a straight stem. The wood is soft, and the leaves are almost elliptical in shape, nearly smooth, and sprinkled with a few stinging hairs. It is found in the Moreton Bay district, and also in North Queensland. M. Thozet mentions having found it on the Fitzroy River.

3. *Laportea moroides*.—A small tree, with most virulent stinging hairs. The leaves, which are about 9 inches long, are covered with short soft hairs on both sides. The fruit, which I have only twice seen, is of a beautiful purple colour, succulent, and densely clustered. This tree is found chiefly in the Kennedy district in North Queensland. Mr. Fitzalan, of Bowen, mentions that it is common about Port Denison and Edgecumbe Bay.

These three stinging-trees, which Bentham and Von Mueller place in the genus *Laportea*, are by many botanists included under *Urtica*.

Of all the stinging-plants of Queensland the virulence of which I have been so unfortunate as to ascertain practically, *Laportea moroides* surpasses the others, both in the severity of the pain produced at the time and in the duration of its effects.

I would refer those who wish for further information on this subject to Bentham's "Flora Australiensis," Vol. VI.

ERNEST BLACK.

A FEW HINTS ABOUT THE RAIN-BAND SPECTROSCOPE.

SINCE writing to the *Times* on the subject of "The Spectroscope and Weather Forecasting," I have had so many letters and inquiries from various parts for information about the rain-band spectroscope and how to use it, that I think a few concise rules and facts in regard to it may prove acceptable to many readers of your widespread and useful periodical. With your kind permission I will briefly mention the following, viz.:—

1. Adjust the focus and slit of the spectroscope so that the lines in the spectrum may be of the clearest definition, and whilst taking an observation, shade the eyes with the hands, in order that all extraneous light may be excluded as much as possible.

2. Observe in a general way from ten to twenty degrees from the horizon, and towards the quarter from which the wind is blowing, but if the latter be not practicable, point the instrument in a northerly, in preference to a southerly, direction.

3. If 80 per cent. of the dark band be shown at the zenith, heavy rain will certainly occur before long.

4. During wet weather, the amount of rain-band may be low; this for the most part denotes fine weather to follow.

5. If the instrument be directed towards the point from which the wind is blowing, and should the clouds be passing in one and the same direction, and 20 per cent., or less, of the rain-band be shown, no rain will follow for at least six hours, in spite of any threatening appearance of the sky.

6. With a knowledge of the course and peculiar characteristic of storms, which is not difficult to acquire (*vide* "Aids to the Study and Forecast of Weather," by W. Clement Sey, M.A.), it is possible to foretell rain by the help of the spectroscope with surprising accuracy.

Observers will not be disappointed if the above suggestions are carefully attended to. The principal difficulty lies in determining the percentage of rain-band; but this is to be overcome by practice and experience, and they will find that after a time the indications of the spectroscope can be read at a glance of a few seconds in duration.

F. W. CORY, F.M.S.

SATURN'S RINGS.

THE volume of "Philosophical Transactions" from which I forwarded you the extract given in No. 49, p. 307, is in my possession, and is peculiarly interesting. The title-page is as follows:—

"Philosophical Transactions: giving some Accompt of the present Undertakings, Studies and Labours of the Ingenious in many considerable parts of the World. Vol. I. for Anno 1665 and 1666." These Transactions were not issued by the Royal Society, but were edited by their Secretary, Henry Oldenburg. The first number was issued on Monday, March 6, 166$\frac{4}{5}$, and was followed by monthly parts in April May, June, July. At the end of the July number is this note:—

"*Advertisement.*—The reader is hereby advertised that by reason of the present Contagion in London, which may unhappily cause an

interruption aswel of Correspondencies, as of Publick Meetings the printing of these Philosophical Transactions may possibly for a while be intermitted, though endeavors shall be used to continue them if it may be."

The next number was issued on Nov. 6, 1665, and was printed at Oxford, as also were the December and January numbers. No. 9, published Monday, Feb. 12, 166$\frac{5}{6}$, the one containing the extract and engraving which I sent you, was published in London. Another interesting feature about this volume is that the printer was changed owing to the original printer having his place burned down in the great fire of 1666. In January, 166$\frac{6}{7}$, we find the following note:—"The publishing of these Tracts is now return'd to the first Printer thereof, as being somewhat re-setled after the late sad Fire of London." The volume terminates with the number for February, 1666—or, as we should now say, 1667.

The fact of these Transactions being issued in monthly parts, and the publishing interrupted by the Great Plague, may have been the cause why so few copies seem to be in existence. The engraving that I forwarded you, I traced on tracing paper, so you may rest satisfied that it was a *fac-simile* of the original. THOS. WARD.

Brookfield House, Northwich.

[Mr. E. W. Maunder, of the Greenwich Observatory, writes to us that the credit of restoring to Cassini the credit due to him (or to Auzout, who made his telescope), for seeing the division in Saturn's ring-system, is due to Mr. Lynn, formerly of the Government Observatory, Greenwich. "Two years ago," he says, "Mr. Lynn pointed out that the sketch said to have accompanied Ball's paper in the 'Phil. Trans.' was omitted from several copies." On Sept. 15 of the present year, Mr. Lynn examined a copy of Lowthorpe's abridgment to Mr. Prince, and the first sight of the diagram there given (a *facsimile* is shown at p. 295 of KNOWLEDGE for Sept. 29) convinced both Mr. Prince and Mr. Lynn that Ball had never recognised the division, or anything like it. Captain Noble and Mr. Prince, the day following, examined the same picture, and arrived at the same opinion. Mr. Lynn wrote to a monthly astronomical magazine, of rather limited circulation, setting forth his opinion that Cassini alone deserved the credit of the discovery; Captain Noble wrote to us to a similar effect, sending a cutting of the picture which he and Mr. Lynn and Mr. Prince had examined. It required a rather shrewd guess (though I say it who perhaps should not) to infer from this picture what Ball had really suspected. But Captain Noble's communication coming at once before many thousands of readers, the natural result followed. An obliging correspondent, Mr. T. Ward, was able to resolve all doubts, by sending a *facsimile* of Ball's original observation, wanting in most copies of the "Transactions." This showed, beyond all question, that what I had guessed was in truth what had happened. The ring had, by an optical illusion, seemed so bent towards the planet's north and south polar regions, as to convey the idea that there were two rings, each touching Saturn on one side, and reaching far from the planet's surface on the other. All this was known to us when we thanked Captain Noble for communicating with us on the subject. We did not ascribe to Captain Noble (as Mr. Lynn states in the *Athenæum*) the first notice of the matter; we simply thanked him for calling attention to it in our columns, and so leading directly to a solution of the difficulty. The moral seems to be that any one who wishes to solve a difficulty of this sort should address a weekly paper of wide circulation, rather than a magazine which appears less often, and addresses a smaller constituency.]

MR. STANLEY'S DISCOVERIES.

A CORRESPONDENT of the *Globe* who has interviewed Mr. H. M. Stanley, says that gentleman has had practically unlimited means at his command, through the generosity of the King of the Belgians, who, moreover, has been the main supporter of several of the so-called International African Expeditions; as Mr. Stanley puts it, he has been in a position to pay for every cubic inch of air he and his men breathed, and every square foot of ground they trod upon. The object of the King of the Belgians appears to have been entirely disinterested—simply to do what he could to render accessible to commerce and civilisation, and thereby develope the resources of the great interior of Africa. For this purpose the Congo formed a splendid channel of communication, only unfortunately, its lower course for many miles is obstructed by impassable cataracts. To surmount this obstruction has been the object of Mr. Stanley's work. He states that already he has carried a well-made road, 15 ft. wide on an average, from below the cataracts, 230 miles along the north bank of the river, far beyond Stanley Pool, and therefore well into the navigable upper waters. To assist him in this undertaking he has not only had native workers, but relays of young Europeans as superintendents; and for this work he finds Englishmen better than any others, and would be glad to have a fresh supply to send out. So substantially has this road been constructed, that it has stood the deluges of rain that break down upon it from the mountain-sides, and has borne the heavy traffic which the transport of engineering plant to the upper reaches has rendered necessary. Causeways have been laid where necessary and bridges built, and the road has, by means of excavations, embankments of stone, and layers of earth, been carried right round the face of a mountain which comes sheer down to the river at one place. On rounding the mountain Mr. Stanley states that the road enters an avenue of exquisite beauty and coolness which has been cleared through the forest. So thickly timbered is the country in some parts that thousands of trees have had to be felled, and their roots either grubbed up or levelled. At intervals along the road stations have been planted, and already there is a regular service of couriers between the stations, and by them a growing trade is being established. As to what are the possibilities of commerce along this route, he states that during the progress of his work a million yards of Manchester goods have been distributed through the country in payment for labour and other services performed by the natives. One of the articles of transport along the new road was a fine steam launch, with which Mr. Stanley has done some good exploring work some 400 miles above Stanley Pool, quite 700 miles above the mouth of the river. When he feels at liberty to publish an account of his work (at present his first duty is to his employer, the King of the Belgians), it will be shown, the correspondent believes, that some first-rate exploring work has been done. The launch, for example, was taken up a new river, opening from the south bank of the Congo, some distance above Stanley Pool, and which, it was found, led into a fine lake. The lake was covered with fishermen's canoes, whose occupants looked aghast at the snorting monster puffing out smoke, and fled in dismay. One, however, was caught, and after being soothed down and kindly treated, was sent off loaded with presents to his wondering fellows peering from among the bushes on the shore. In Mr. Stanley's opinion the soil is capable of unlimited development for crops of all kinds, and, by judicious use, the supply of caoutchouc in the forests is inexhaustible. The greatest difficulty to the utilisation of the river

throughout its navigable length is the almost untamable cannibal tribes who inhabit the upper reaches between Stanley's furthest point and the neighbourhood of Nyanginé.

Reviews.

PLAIN WAYS IN SCIENCE.*

By the Editor.

MR. WILLIAMS says he is not aware that the reprint of his scattered essays demands any apology. Evidently he is not aware that Mr. Christie, the Astronomer-Royal, considers there is "no practice more reprehensible," and that an anonymous writer in the *Atlantic Monthly* (afterwards identified as Mr. Edward Holden, then of the Washington Observatory, now chief of the Ann Arbor Observatory, Michigan) compares this habit to highway robbery. For my own part, I share Mr. Williams's opinion; nay, I go a little further, considering that essays which will not bear reprinting were probably not worth writing. As for the time of making such reprints, surely, as Mr. Williams says, they are likely to be much better done by the author himself than by his friends after his death.

The volume before us is full of interesting matter. Mr. Williams has not a particle of respect for mere authority, so there is no lack of novelty in his views. Some of his new theories are open to exception; but they are all well worth considering. I had marked a number of the essays in the present volume for notice as interesting and valuable; but have finally decided to speak only of the theory or theories advanced in Mr. Williams's "Fuel of the Sun," here concisely presented in the opening essay (thirty-four pages in length), and touched on in the second, a much shorter paper, relating to Dr. Siemens's "Theory of the Sun."

The new theory opens with the argument that Wollaston was wrong in regarding the atmospheres of the earth and other members of the solar system as limited. Mr. Williams attaches great importance to this point, considering that if he is right, all our standard treatises on pneumatics and meteorology must be remodelled. I cannot, for my own part, see why. I doubt very much whether Dr. Wollaston's paper has ever been held to be of great importance, or whether it has ever been regarded as demonstrated that the planetary atmospheres are limited. Certainly the atomic theory, as it has been maintained for many more years than have passed since Mr. Williams's theory was advanced, is inconsistent with Wollaston's opinion, and still more obviously with the reasoning by which Wollaston attempts to establish his opinion. The rather daring theory of Le Sage as to the true cause of gravitation may be cited as an illustration of what is undoubtedly the case, that many before Mr. Williams have regarded interplanetary and interstellar space as occupied by matter.

As for the consequences of the opinion maintained by Mr. Williams (most probably right), he is, I take it, quite mistaken in supposing them to be of great importance. He finds the objections urged against his views, and Dr. Siemens's later ones, invalid when once the atmospheres of the heavenly bodies are regarded as unlimited. I have myself received more than one letter pointing out that this is so. (Dr. Siemens himself is of course persuaded that it is.) But the argument is based on the mistaken idea that because there is no definite limit to a planet's atmosphere (or *if* there is no such limit), the atmosphere which at any instant envelopes a planet is freely interchangeable with the interplanetary atmosphere. But this would not be the case. Interchange could only take place in accordance with dynamical laws, and these would not permit of more than an infinitesimal interchange between the atmosphere immediately surrounding a planet and the attenuated atmosphere beyond. Mr. Williams recognises this as soon as he tries to set his perpetual solar machine working. "The sun will carry its own special atmospheric matter with it, but it cannot carry the whole of the interstellar medium. There must be a limit—graduated, no doubt, but still a practical limit—at which its own atmosphere will leave behind, or pass through, the general atmospheric matter." This admission, though convenient where it is made, carries death with it to Mr. Williams's theory, for it leaves things practically as they would be if Mr. Wollaston's theory were unquestioned.

Mr. Williams conceives the sun as rushing along through space, gathering in the atmosphere of space as it goes, compressing that atmosphere with all the energy with which a normally limited atmosphere would be permanently compressed, and so by its gravitating energy producing intense heat, instead of that merely constant pressure which would naturally result in the case of a constant atmosphere. But neither the onward rush of the sun through space, nor that swaying of the sun around the common centre of gravity of the solar system, which Mr. Williams regards as an all-important point in his theory, could produce any such effect. If we imagine the sun without his atmosphere, drawing that atmosphere in from surrounding space, he would unquestionably, in drawing it in, produce all the heat in which Mr. Williams believes. And that heat might be stowed away, so to speak, in dissociating the aqueous vapour so gathered in, to be presently distributed as the elements recombined. But with that first ingathering of atmosphere would be the end of this particular source of solar heat. The heat thus stored could be given out, but no more, or only so much more as corresponded to the exceedingly slight interchange taking place at the outskirts of the solar atmosphere. Mr. Williams speaks as if the whole of the long cylinder of interstellar atmosphere actually traversed by the sun were gathered in and compressed to the full tension of the solar atmosphere. But this could not happen. The sun would travel through that atmosphere, losing from his own (and taking up from outside to replace) only so much as friction at the outskirts of his atmosphere would displace.

If there could be any doubt, when the question is viewed as a hydrodynamical problem, that this is so, it should be removed by the consideration that were the processes conceived by Mr. Williams to take place, one side of the sun would inevitably present an appearance differing in the most striking manner from that of the other side. On the forward hemisphere, there would occur a constant ingathering of so much atmosphere as, when compressed by solar attraction, would produce the heat which Mr. Williams's theory requires. (For note that the mere *state* of compression does not cause heat, but only the forcible compression of vaporous matter which had been uncompressed). All the heat thus generated on one side would be used up in dissociating the aqueous vapour of the atmosphere so gathered up. On the other hemisphere the converse process would be taking place. The dissociated gases would there rise, would combine, with intense emission of heat, and the products—the cinders left after the solar firing—would be flung away in the wake of the advancing sun. (At least Mr. Williams's theory requires that this should happen.) Now,

* *Science in Short Chapters.* By W. Mattieu Williams, Author of the "Fuel of the Sun," "Through Norway with a Knapsack," &c. (Messrs. Chatto & Windus, London.)

astronomers have the power of observing at one season of the year the advancing side of the sun, and six months later the retreating side; and they might fairly expect that regions where such opposite processes are at work on so gigantic a scale would present a very different appearance. But no one has ever yet recognised the slightest difference between the side where the sun is, as it were, shovelling in fuel (turned towards the earth during the spring of the northern hemisphere) and the other side where he is shovelling out cinders. Both sides look exactly alike.

There is another feature of Mr. Williams's theory which he specially defends against criticisms of mine. I had objected that bodies travelling round the sun could never have come into existence as a result of ejections from the sun. Granted, says Mr. Williams (though that was not exactly the way he put it in "The Fuel of the Sun," I think), if there were only simple ejections, but if, after matter has been ejected, it explodes like a rocket, "pretty generally all round," a ring of meteors might be formed; and he cites the behaviour of the coloured prominences of the sun as showing that this actually happens. It is true they often, after shooting up from the sun's surface, expand laterally, but there is nothing in this more than we see in every case in which gaseous matter is shot through a region of high pressure into a region of low pressure. That matter shot to a height of say 70,000 miles from the sun's surface, should *there* explode laterally, so as thenceforward to circle around him, the matter exploding must divide itself into opposite portions, each travelling from the point of explosion with a velocity of more than 240 miles per second. Nothing of this sort, or approaching anywhere near this, has ever been seen. Moreover, what is there except expansive action to produce lateral motion at all in the ejected gases? and how can lateral expansion do more than extend the expanding matter until its density is equal to that of the atmosphere around it at the same level? In the case of terrestrial bomb-rockets there is an enclosing case which holds the explosive substance until, on ignition, the gases are formed which, by their expansive action, drive out the particles of matter which form the luminous display. The circumstances are therefore favourable to the forcible expulsion of matter. It is different in the case of the gaseous matter expelled from the sun, when the outrush is over. For the glowing gas driven violently outwards on these occasions is not enclosed in any way. It is simply (as the spectroscope shows) driven up as a stream of dense gas in a relatively rare atmosphere; and as soon as it can (which is generally not before it reaches a higher and still rarer atmosphere) it expands laterally. There is nothing explosive about this action, any more than there is in the lateral expansion of cumulus clouds, or (which more nearly illustrates the case) in the outspread of cloud above a volcano after each outburst of the gases which had been imprisoned within. If there were the enormous lateral velocities required by Mr. Williams's theory, the spectroscope would long ere this have revealed them; but while it gives clear evidence of cyclones low down in the solar atmosphere, as shown by motions towards and from the eye at the sun's edge, it has never shown any trace of such motions in the glowing gas flung high above the sun's surface.

There is, however, much that is well worth studying in Mr. Williams's reasoning. His conclusions seem to me, for the most part, quite erroneous, but the evidence he quotes in their favour is deserving of the most careful examination.

Mr. Williams considers that his views have been and are being adopted by other writers on astronomical and physical matters, "without corresponding acknowledgment"; and he tells us that in due time "an appendix to the 'Fuel of the Sun'" will be published (to a new edition, I trust), giving the particulars of such adoption. I doubt the wisdom of this. These questions of priority are fit only to occupy very small minds; and I am sure Mr. Williams agrees with me in regarding all egotism as silly:—even the appearance of it is a thing to be avoided. But if he does what he proposes, he will have to be careful lest peradventure he should find the boot unmistakably on the other leg. He has a clear case against Dr. Siemens, though I feel well assured Dr. Siemens was not aware, when he published his theory, how fully all that was sound in it, and a great deal also that is unsound, had been anticipated by Mr. Williams. But in some other cases, where he hints a suspicion that his views have been adopted without acknowledgment, he will find priority (*valeat quantum valere debet*, which is not saying much) with others. For instance, the theory that the larger planets are miniature suns, "surrounded by a sphere of vapour, the outside of which we see," he includes among his startling conclusions, "utterly at variance with general astronomical opinion when he reached them." When he *reached* them I do not know, but I do know when he published them; and I know that several months before, in the winter of 1869, I advanced that theory in a series of lectures delivered at the Royal Institution, Manchester (in the syllabus of which the theory was stated in so many words), while for at least a year before that, the probably intensely-heated condition of the giant planets had been dealt with in the MS. of the work afterwards published under the title of "Other Worlds than Ours." Mr. Williams could not be expected to know about the Manchester lectures, but he must know enough of the conditions under which books are published to be well aware that the chapters on the giant planets in the middle of that work were written, and even in type, before his "Fuel of the Sun" was published. The theory was announced by me long before. Not that it matters in the least, only: if such questions *are* to be raised, we may as well raise them by the right end.

THE DOOMED COMET.*

This little pamphlet, price sixpence only, gives a good deal of interesting information about cometic astronomy. It deals chiefly, in the first part, with the comet now shining so conspicuously (when the weather is clear) in our morning skies. In the second part, it discusses the possible effects of the comet's absorption by the sun; and, in passing, criticises the theory of sun-spot influences with an engaging frankness which we fear will prove somewhat distasteful to the believers in that theory. Mr. Oliver arrives at the conclusion that there will be "slightly intensified meteorological phenomena," whenever the comet is absorbed. He believes that the British Isles will be affected in "a way such as to induce warmer and drier weather, or in other words, good seasons," opposite conditions prevailing (with important local variations, however) in Eastern Europe, India, Australia, and North America. We (the Editor) wished we knew enough to guess a tenth of what Mr. Oliver seems somehow to know. Mr. Oliver says, by-the-way, that we have twice misled the public on the subject of this comet. We doubt if we have misled them once. What we said erroneously in Knowledge of Oct. 6 was corrected in five daily papers, having an aggregate circulation of half-a-million, on the morning of Oct. 7. As

* *The Doomed Comet and the World's End.* By J. A. Westwood Oliver. (Wyman & Sons, London.)

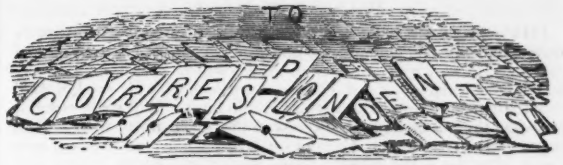
for the "glaring mistakes" in our essay on "A Menacing Comet," we should be obliged if Mr. Oliver would point out what they are. We apprehend he mistakes the mistakes we corrected, for mistakes we had made. We see nothing in the essay to correct; when we do we shall say so!

A Mysterious Well.—James Beatley, of Huntingdon, L.I., has a well on his premises that is both a curiosity and a puzzle. The well is twenty-three feet deep, and is dry every year from Jan. 1 to the first week in March, as regular as the days of the year. It will be as full the day before it dries up as at any time during the year, and on the following morning not a drop of water is to be seen where a depth of three or four feet existed before. About the first week in March the well fills again in a few moments, and the water remains for the remainder of the year.

Professor Tyndall on Dr. Siemens' Solar Theory.—"It would give me extreme pleasure to be able to point to my researches in confirmation of the solary theory recently enunciated by my friend the President of the British Association. But though the experiments which I have made on the decomposition of vapours by light might be numbered by the thousand, I have, to my regret, encountered no fact which proves that free aqueous vapour is decomposed by the solar rays, or that the sun is re-heated by the combination of gases, in the severance of which it had previously sacrificed its heat."—*Longman's Magazine.*

Coal in British India.—Coal of good quality for locomotive purposes is systematically worked in the Bengal coalfields, which extend for about 100 miles to the west of Burdwan. Collieries exist also at Wahrora and Mohpani, in the central provinces. A very valuable coalfield is known to exist at Makum, in Upper Assam, which will doubtless be opened out when the Assam Light Railway is completed. The total output of Indian coal in 1880 was 1,016,040 tons, of which by far the greater amount was raised in the Raneegunge coalfield. Madras finds it cheaper to use patent fuel from England than to depend upon Indian coal brought from long distances by land. The total quantity of English coal, coke, and patent fuel imported into India during 1880-81 was 683,768 tons, valued at £1,239,805.

An Electric Tricycle.—The improvements in the storage of electric energy and in electro-motors have so far advanced that tricycles can be lighted and propelled by electricity, as was seen from the tricycle ridden last week by Professor Ayrton in the City. The Faure accumulators in which the energy was stored for the lighting and driving were placed on the footboard of the tricycle, and the motion was produced by one of Professors Ayrton and Perry's newly patented electro-motors, placed under the seat of the rider. Using one of these specially made tricycle electro-motors and the newest type of the Faure accumulators, the total dead weight to be added to a tricycle to light and propel it electrically is only 1½ cwt., a little more than that of one additional person. In the tricycle ridden by Professor Ayrton the ordinary foot treadles were entirely absent, but with ordinary electric tricycles it may be desirable to leave the treadles, so that while electric propulsion alone is used on the level, the rider can, on going up a steep hill, supplement it by using the treadles, instead of, as at present with the ordinary non-electric tricycle, having to get out and ignominiously push his tricycle up the hill before him.



Letters to the Editor.

[The Editor does not hold himself responsible for the opinions of his correspondents. He cannot undertake to return manuscripts or to correspond with their writers. All communications should be as short as possible, consistently with full and clear statements of the writer's meaning.]

All Editorial communications should be addressed to the Editor of Knowledge; *all Business communications to the Publishers, at the Office, 74, Great Queen-street, W.C.*

All Remittances, Cheques, and Post-Office Orders should be made payable to Messrs. Wyman & Sons.

**** All letters to the Editor will be Numbered. For convenience of reference, correspondents, when referring to any letter, will oblige by mentioning its number and the page on which it appears.*

"In knowledge, that man only is to be contemned and despised who is not in a state of transition. . . . . Nor is there anything more adverse to accuracy than fixity of opinion."—*Faraday.*

"Show me a man who makes no mistakes, and I will show you a man who has done nothing."—*Liebig.*

HAS THE MOON AN ATMOSPHERE?

[614]—This question has been a debatable one with astronomers, though generally answered in the negative; there, however, seems to be, from what Mr. Ranyard has to say upon this subject in his paper on pp. 215-246 of this volume, every probability that the question as to the existence of a lunar atmosphere will soon be definitely settled. At the conclusion of the highly-interesting paper above referred to, Mr. Raynard makes a few remarks upon a curious phenomenon to be seen at the time of the new moon, viz., a faint line of light round the dark limb of the moon; and requests observers to take notice of it, and send the results of their observations to Knowledge. Unfortunately, since the publication of Mr. Ranyard's paper, cloudy weather has prevented me observing the moon when sufficiently near conjunction; and as I think this phenomenon, if carefully observed, is likely to throw some light upon the question heading this letter, I venture to call attention to it, because in a climate like ours it is necessary that there should be several observers, as it often happens that one observer will see some phenomenon that an observer at another place is unable to observe on account of bad weather.

In his paper, Mr. Ranyard suggests that this "line of faint illumination" may possibly be due, either to "a dispersion of the sun's rays within an atmosphere," or else "caused by a phosphorescent light from the lunar surface." With regard to the first of these suggestions, I would like to ask whether an atmosphere of sufficient density to make itself visible as a "line of light" would not have some effect upon the occultations of stars? Respecting the latter suggestion, I should like to know whether any observer has noticed the "line of faint illumination" along the dark limb of the morning moon? B. J. Hopkins.

[After what Zöllner's photometric observations have proved (to all intents) as to the average slope of lunar mountains, it is tolerably clear that that arc of light should be seen—whether moon has appreciable atmosphere or not.—Ed.]

ANCIENT MONUMENTS.

[615]—In the Government list of ancient monuments to be protected (in No. 47, Sept. 22), I am sorry to observe that one interesting relic is omitted. It is a cromlech called Arthur's stone, in Hertfordshire, about 15 miles W. of Hereford, on the ridge that bounds the Golden Valley (Valley of the Dwr), to the N.E., and close to the picturesque little village of Dorston (Dwr's town, or the town on the Dore). Originally it was covered with stones and earth, forming a mound, and is situated where a lane crosses an ancient British road that ran along the ridge, and is crossed farther south by a Roman road that led to Abbey Dore. It consists, like Kit's Coity House, of a stone supported by several others, but the supporters are more numerous, and smaller, and the top stone much larger than at K. C. H. There is to the N.E. of this relic about 100 yards, just as at K. C. H., another large stone lying down. There is a fine view from this spot of the whole Golden Valley, with its Norman castles, its Abbey, and ancient tumuli of the Black Mountains, that separate Herefordshire from Brecknock, and in the extreme S.W., the Great Skirrid, Horned, or Holy Mount. A line drawn through the long axis of the top stone if extended would just touch the Skirrid. J. E. S.

XUM

ICHNEUMON WASP.

[616]—With his head to the wind, his legs tucked up neatly under his body, his yellow bars gleaming in the sun, his whole self moving very slowly windward, an insect which I half guess is the ichneumon wasp gives out, clear and musical, with his prodigiously rapid wings, the note B flat (third treble line). Will some one tell me what the insect is, how it keeps in one place until, with a dart, it proceeds to make its wing-music heard some yards away, how many vibrations per second those marvellous wings make, and lastly, whether it is known how that enormously rapid muscular movement is executed? G. R. WYNNE.

MONKEY AND MIRROR.

[617]—"Deo Fido's" monkey is not singular in its proceedings with the looking-glass. Many years ago, when voyaging home from Manila, I bought a little monkey at Anjer (Straits of Sunda), and his antics with a looking-glass caused us much amusement. He would first of all carefully put his paw behind the glass, and then, finding nothing there, would look cautiously "round the corner." This would look like a measure of intelligence, as "Deo Fido" observes; but my monkey must have had a very bad memory, for he never remembered the previous deception, but always, with an equal show of caution, went through the same antics on seeing his own image in the glass. A. M. D.

[Perhaps, however, this extra caution was the result of abstract reasoning. He may have thought that what had been proved in some cases might not be true for all.—ED.]

Answers to Correspondents.

**** All communications for the Editor requiring early attention should reach the Office on or before the Saturday preceding the current issue of* KNOWLEDGE, *the increasing circulation of which compels us to go to press early in the week.*

HINTS TO CORRESPONDENTS.—*1. No questions asking for scientific information can be answered through the post. 2. Letters sent to the Editor for correspondents cannot be forwarded, nor can the names or addresses of correspondents be given in answer to private inquiries. 3. Correspondents should write on one side only of the paper, and put drawings on a separate leaf. 4. Each letter should have a title, and in replying to a letter, reference should be made to its number, the page on which it appears, and its title.*

RESURGAM. I should say you could not do better than to use Todhunter's smaller algebra. It is not possible to say whether you could go through quadratic equations, or the four first books of Euclid, without a master; persons differ so in their ways of learning. The mathematics I have learnt from masters and lecturers is almost naught. As regards Latin, if you want it for use, try the Hamiltonian method; and after reading a few books by that method, look up some simple grammar. You will find the grammar quite interesting when you know something of the language. You can teach yourself to read most Latin books in that way in a few weeks, and very pleasantly. If you want Latin for show, you should have a master. He will teach you how to pronounce it in several now authorised ways, each utterly unlike its nearest neighbour; you shall learn the rules in Latin before you can read a line of any book; after five or six years you will have a quantity of knowledge very recondite and very useless to you; but then you will forget it all in about the same time.—HY. BROCKBANK. There is no connection at all between the colour of stuffs and their conducting power. Dark clothes are warmer than light for one reason only,—they absorb more heat. All the other statements quoted from Mr. Dunman's book are wrong, but not (as you seem to think essential to wrongness) the *reverse* of the truth. It is wrong to say that dark clothes conduct heat better than light ones, for there is no such general rule; but it does not follow that light clothes conduct heat better than dark ones. Nearly always when persons unfamiliar with the laws of heat try to teach, they confound together more or less hopelessly, radiation, conduction, convection, and absorption.—J. BEDFORD. Have you not yet learned that you are known?—ARCTURUS. When a meteor falls with thundery accompaniments, the inference is that the meteor produced the electrical phenomena accompanying its fall. Certainly, there is no connection between meteors and ball-lightning.—R. H. You are quite right; photography applied to galloping horses shows what is, not what the eye sees. Art has shown what the senses recognise, not what is. I attach great value to the work of Mr. Muybridge, M. Marcy, and other rapid photographers; but for scientific not artistic reasons.—AERIAL NAVIGATION. There is an English Society for advancing aerostation. No great progress has yet been made. Do not know what is the relative position of Europe and America in the matter of ballooning.—R. J. P. We have not heard that mules in this country suffer specially from pains of the kind, but they may do so for aught we know to the contrary.—ONLY A WOMAN, J. HAZELDEAN, J. W. B., R. M. N., SAML. Y., T. V. DUVERNAY, WM. I. NEWTON, A FATHER, G. Y., D. O., HARVEY, and many others. We are glad to find so large a portion of our readers agree with us about the portraits in question, though, indeed, we do not suppose anyone who holds the women of his family in just regard could well do otherwise. As two of you write, it is not a question of the propriety or impropriety of certain pictures. It would be prudery, indeed, to object on such grounds. There are several pictures in the National Gallery to which "nice" persons (that is, persons with nasty ideas) might object with far more reason. But no sensible person cares about those. Nor does the objection to these pictures reside in the evidence they afford of immorality among princes. There is immorality everywhere; and it is a matter of no more moment that King This, or Prince That, or Grand-duke So-and-so neglects his wife, and finds himself more at home with persons of lax morality, than it is that the same should be the case with Brown, or Jones, or Noakes, or Styles. What every man of honour who thinks on the subject must feel, is the insult conveyed, in the selection of pictures such as these, as if they represented persons in whom the nation, *as a nation*, ought to feel interest.—T. JARDINE PERKINS. How do the above remarks suit you by way of explanation? Of course, you are right in saying that the gallery is not a Female Excellence Gallery, but a National Portrait Gallery. That is the trouble. You are "loth to believe that I do not consider these women's portraits national." Do you? They are just as national to my mind as would be portraits of any other persons of more or less lax principles, acquaintance with whom had happened to suit any of our kings, as, for instance, portraits of the fellows employed by Hubert to torture Prince Arthur, or the persons selected by Richard III. for his villanies. I take it a National Portrait Gallery should contain pictures of all statesmen, whether their influence was good or bad; of soldiers and sailors of renown; of poets, historians, and all men great in literature, art, or science; of kings, princes, and others of high position through their birth or family, with special place for those among them whose influence was used for the benefit of the nation; nor should the circumstance that any one, otherwise great, had been guilty of offences, even of deep dye, cause their portraits to be regarded as objectionable in a National Portrait Gallery. All women who have had high position in the nation, and all who have been famed in art, or science, or literature, should, of course, be there. And certainly, also, the mothers, wives, sisters, and daughters of famous men should in many cases have a place, especially where they had had much influence on the career of such men. But what earthly interest there can be to any sound mind in the domestic irregularities of princes, or why one particular class of irregularities should be selected as worthy of national celebrity, I think you would find it very difficult to show. How would it be if the queen and each woman in the land who ran the least risk from her position of having her portrait put along with these "beauties," were to leave express injunction in her will that she should not be exposed to such indignity? As for your threat,—here is a little parable for you:—"Passing down Newspaper-row, in New York city, one morning, the late Horace Greeley met one of his readers, who very excitedly exclaimed, 'Mr. Greeley, after the article you published this morning, I intend to stop your paper!' 'Oh, no,' said Mr. Greeley, 'don't do that!' 'Yes, my mind is made up; I shall stop the paper.' Late in the afternoon the two met again, when Greeley remarked, 'Mr. Thompson, I am very glad you did not carry out your threat this morning.' 'What do you mean?' 'Why, you said you were going to stop my paper.' 'And so I did; I went to the office and had it stopped.' 'You are surely mistaken. I have just come from there, and the press was booming.' 'Sir,' said Thompson, very pompously, 'I mean I intended to stop my subscription to your paper.' 'Oh, thunder!' ejaculated Greeley. 'I thought you were going to stop the running of the paper, and knock me out of a living. My friend, let me tell you something; one man is just a drop of water in the ocean. You didn't set the machinery of this world in motion, and you can't stop it; and when you are underneath the ground, things upon the ground will wag on the same as ever.'"—J. T. D. You are one of a very small minority. If the pictures were put there to show how depraved the nation has been at times (though I expect there has not been any great change in the nation as a whole, so that you should rather have written "court," than "nation"), there would be no serious objection. But that is very far from being the case. I wish, by the way, that every reader of KNOWLEDGE had had the opportunities I have had of learning how Foreign, American, and Colonial visitors of the higher types of character view these pictures. That they regard them as insults to the people need hardly be said.—W. B. BIRD. That allusion would be "rude," no doubt, if not justified by the utter rudeness of what it referred to. As regards Kew Gardens, how do you get away from

'Arry and 'Arriet *now?* What change have I proposed that would add to their opportunities of being annoying? I am glad to say that not one letter in fifty which has reached us takes your view about arrangements *which keep out all alike.* I think, for my own part, the wall is the chief offence. It deprives the public of the general view of the grounds, which is their chief beauty. Inside, there is much that is in such bad taste,—inartistic effects, tawdry colour-combinations, hideous false ruins, and so forth, that the public lose less by the late opening than they otherwise might.—ELT. H. JULES. The rainbow can be photographed after a fashion; only the violet and blue part come out well. It is in one sense true that the rainbow exists only in the eye of the observer; so does every image of optical effects; but the very fact that there is an image in the eye shows that an image would be formed on the photographic plate.—JAS. DEAS. Undoubtedly a solar spot, unless you saw it move, in which case it was probably a distant bird.—D. M. J. Many thanks for your very kind expressions about KNOWLEDGE. You are quite right; when we asked the opinion of our readers about the weather chart, we received so many letters from those who otherwise would not have written to us, and these letters were so kindly written, that we learned how very small a part of our readers the grumblers are.—A SUBSCRIBER. Prof. Young's book on the sun is now published by Messrs. Kegan Paul & Co.—N. W. S. You will find that the solution involves what I said. The illumination varies as the square of the distance inversely, and also as the sine of the angle LBA directly; but the sine of this angle varies inversely as the distance LB. This introduces the inverse distance yet a third time, altering the inverse square to the inverse cube.—SCIOLIST. I stop at your first statement. The comet of 1843 may, you say, have obeyed another sun, and what happened may have been due to some change in that other sun (one of its foci, you say). Are you aware that before that comet could have felt the influence of any other sun appreciably (even though that other sun were the nearest of all the stars) some five millions of years would have to elapse? EDINA. A simple way of ascertaining whether a room is damp or not is to bring into the room a polished glass or mirror at a temperature cooler than that of the room, at a time when the room has for an hour or so been free from living occupants (whose breath might otherwise moisten the air). If the room is damp, a slight mist will form on the glass.—C. G. W. Thanks for your letter about the comet. You will see that we show our readers where to look for it.

ELECTRICAL.

DENTIST. I do not remember having read or heard that electricity has the power you mention, but I certainly should recommend you not to try it in the way you suggest. The shocks from a coil are exactly the reverse to anæsthetic in their influence, even when applied to the least sensitive parts of the body. When applied to any of the organs of the head, they develope more or less intense pain, and, by virtue of their intermittent nature, there is a constant tendency to motion. You propose that the patient's hands shall rest on the arms of a chair in connection with one of the coil-wires, the other wire being connected to the forceps. The forceps being insulated (this you may do by encasing the handles in vulcanite, or by wearing a thick india-rubber glove), you would apply them to the gum in the vicinity of the tooth to be extracted. Has it never occurred to you that every time a shock is imparted to a dead body (as, for instance, to Galvani's frog) that body is subjected to a convulsive movement? Would not the effect be even greater in the case of a living body, especially one unaccustomed to such influences? The battery of which you enclosed a sketch is what is generally known as the "Bottle Bichromate" (on account of its shape), and is expensive because there is usually a deal of work about it. For a simple or less expensive form see next answer.—J. H. WARD. Pleased to hear you succeeded with coil. You could scarcely get a bichromate cell by following the instructions given in KNOWLEDGE for June 23, seeing that those instructions were for making a Leclanché cell. The number of cells required to heat two inches of platinum wire would depend on the diameter of the wire. To make a simple bichromate cell with two zinc and three carbon plates, the plates may be separated by means of strips of paraffined wood, $\frac{1}{4}$ to $\frac{3}{8}$ of an inch in section. The strips may be so arranged as to allow you to fix a clamp across the two zincs. The carbon plate in the centre should not be in contact with this clamp, but a conical-shaped hole should be scooped out, into which a copper wire should be fixed by pouring in a little molten lead. The external carbon plates may be treated in the same way, and the three wires clamped together, or a clamp screwed on to them, and a wire from the central plate attached to it. A stout india-rubber band will hold the set together, little pieces of paraffined wood or ebonite being placed between the plates at their lower extremity.—W. G. PINFIELD. The source of electricity in the dynamo machine is to be found in the steam-engine which drives it. Friction has nothing to do with the generation of the current, a question which is entered into in previous articles in KNOWLEDGE on induced electricity. There should be no wear, unless it be that due to friction at the bearings.

Our Whist Column.

BY "FIVE OF CLUBS."

WHIST ODDS.

A CORRESPONDENT, "A. B.," sends the following reasoning (given in a letter to the *Asian*) for analysis. The writer is showing how the odds on the rubber, after one game has been played, are calculated:—"Supposing *A* to have won the first game, there are four different ways in which two games can be played, and only four:—

	2nd game.	3rd game.	
(1)	*A* wins	*B* wins	*A* wins the rubber.
(2)	*A* wins	*A* wins	*A* wins the rubber.
(3)	*B* wins	*A* wins	*A* wins the rubber.
(4)	*B* wins	*B* wins	*B* wins the rubber.

From this we see that in three of the cases *A* wins the rubber, and only one in which *B* wins. Hence the odds on *A* should be 3 to 1." Of course, in cases 1 and 2 the third game is not played, but is only given to show the different ways in which two games can be played.

On this, A. B. remarks, "It seems to me that the first two cases are really one and the same, as the third game is not played; and that, therefore, only three ways are to be considered, viz.:—

Supposing *A B* to have won the game—

2nd game.	3rd game.	Rubber.
A B win	—	*A B* win.
Y Z win	*A B* win	*A B* win.
Y Z win	*Y Z* win	*Y Z* win.

which would make it 2 to 1 on *A B*; but I suppose I am wrong in my deduction.

The reasoning of the *Asian* correspondent is correct. We must consider both ways in which the two games *might* be played for *A B* to win, although in one case there is no occasion to play the second. The correctness of the result may, perhaps, be best shown thus:—

Suppose there were $4n$ trials to determine experimentally the true odds, n being some very large number. Then we know that in about half, or $2n$, of these trials *A B* would win the first game. In all these $2n$ cases (about) *A B* would win the rubber. In the other half, or about $2n$ cases, *Y Z* would win the first game, and a third game would have to be played. Of the $2n$ (about) third games thus played, *A B* would win about half, or n games, and in each of these cases they would win the rubber. Thus in all they would win the rubber in about $2n + n$ or $3n$ cases out of the $4n$, while *Y Z* would win in about n cases. Thus the odds in their favour are $3n$ to n, or 3 to 1.

Note, that all the law of probability assures us of is that *A B* will win (the players being assumed of equal skill) in about $3n$ cases out of $4n$, or in $3\,n \pm r$ cases, *Y Z* winning in $n \mp r$ cases, where, if n is very large, r will be very small compared with n. Thus the proportion of wins to losses will be $3n \pm r$ to $n \mp r$, or $3 \pm \frac{r}{n}$ to $1 \mp \frac{r}{n}$, where $\frac{r}{n}$ may be made as small as we please by sufficiently increasing n.

EDITOR.

ERRATUM.—Page 367, col. 1, line 6 from foot, for "Ace, King, Knave, nine," read "King, Knave, nine, five."

ANSWERS TO CORRESPONDENTS.

WALTER.—The law is explicit. It says, "on his own or any other pack." Therefore, if the trump card is placed face downwards, quite apart from the dealer's cards or any of the others, it is not a misdeal. — A. WELLESLEY. Your suggestion seems to us excellent. Will see what printers say to it, and follow it if possible.—VACNOL. It would scarcely have been right, though it would have turned out well for Mr. U. (who was *Y*, by the way,—and we think *YY* to play as he did), to have played the King second-hand to trick seven of last week's game. The presumption was that our Editor did not hold the Ace and four others, the usual lead in that case being the Ace. If he did not, *Y Z*'s game was sure; for from the play *Y* knew that *Z* held the winning Heart and the winning Spade, so that the trick wanting

XUM

was sure to be made unless *AB* could make five tricks in Diamonds. Observe, *Y* knew nothing respecting *A's* strength, either in Diamonds or Hearts. Length in Diamonds might, for aught he knew, lie with *B*, for *A* would not have led a Heart, even if he had held only one Diamond, knowing *Z* to hold the Queen. Unless *A* held the Ace and four other Diamonds, or *B* the Ace, Queen, and three more, or Ace, Queen, and a small one (*A* holding the Knave and originally five in suit), *Y's* play of the small card made the game safe, while his play of the King would have done no good in the last two of these three cases. As the Editor's play seemed to show that he did not hold the Ace and four others, *Y* showed sound judgment in holding up the King. *A's* false lead, in point of fact, saved the game.—FIVE OF CLUBS.

Our Chess Column.

BY MEPHISTO.

SOLUTION.

(Problem No. 58 by Leonard P. Rees, page 348.)

1. B to K5 — 1. K takes B or K to B2
2. Q to K7 or K8 (mate)

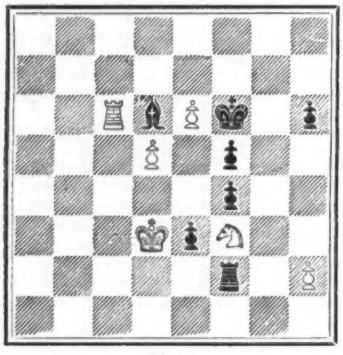
any other name.

2. Q to B6 (mate).

Sir,—I forward diagram of an actual ending of a KB's opening played recently in Dulwich.

Contrary opinions having been expressed as to the final result, it was agreed to give the position a thorough analysis, and score it accordingly. I append some of the workings, and shall feel obliged if you, or some of your readers, will kindly express an opinion as to the merits of the position. SENEX.

BLACK.



WHITE.

[Our space does not permit us to give the analysis of "Senex," and our refutation of it. We find the position admits of some interesting play, but the result ought to be a draw.

If 1. R takes B — 1. R takes Kt
2. R to Q7 — 2. R to R6.

This is Black's best move. It stops the advance of White's K'sP, as Black always threatens to win it by P to K7(ch), followed by R to K6(ch), and the Black King cannot be separated from the White Pawns, while the White King must remain near the Black Pawns, the result being a draw.

If 3. R to B7(ch) — 3. K to K4.

(If the Rook had played to KR7, Black would likewise have played to K4, but if the Rook had played away anywhere on the Queen's side, Black would win by R takes P, followed by R to Q7(ch)).

Now White has no better move than to play the Rook back to Q7, in which case Black would play his King again to B3, thereby drawing.

White also has another move at his disposal which would not lead to a more satisfactory result.

If 4. P to K7 — 4. P to K7(ch).

It is clear now if 5. K takes P, R to K6(ch). 6. K to B2, K takes P, the game is a certain draw. But should White attempt to win the game, which a good many players (including ourselves) would attempt to do in a similar drawn position, they would lose. Instead of 5. K takes P, White might attempt to play his King out of check, and if Black would reply by P Queening, White's Pawn would also Queen with a check and win Black's Queen, but in spite of this Black would win.

If 5. K to B4 — 5. R to QB6(ch)!

(Of course if K takes R Black wins by P Queens with a check.)

6. K to Kt5 — 6. R to Bsq
7. R to B8 — 7. K to Q3!

This move wins whether White replies with (*a*) 8. R takes R, or, (*b*) P to K8 (Queen).

(*a*) If 8. R takes R — 8. K takes KP
9. R to QBsq (best) — 9. P to B6
10. R to Ksq — 10. K to Q3
11. K to B4 — 11. P to B7 and wins.

(*b*) If 8. P to K8(Queen) — 8. R takes Q
9. R takes R — 9. P to B6
10. K to B4 — 10. P to B7 and wins.—ED.]

Referring to the game on p. 70, and further remarks on p. 302, I am not quite sure that 20. B to QR3 would result in a draw, as my analysis, if sound, will show. EXPERTO CREDE.

20. B to R3
21. Kt to B7(ch) — 21. K to Qsq
22. Kt takes B

[Experto Crede now proceeds to show in an interesting manner that to any of Black's replies, such as 22. Kt takes Kt, or K to K sq, or Q to B6, or Kt to K2, or B to B7, B5, or Kt 6, White has a winning rejoinder. But all these numerous replies do not include the right one, which is—

22. Q takes P

If 23. B to B7(ch) — 23. K to K sq
24. Kt to Q6(ch) — 24. K to B sq

Now the Queen on R7, by defending the Black KBP, prevents the mate, and White must therefore be content with allowing Black to draw after Q takes R by Q takes BP(ch), as indicated on p. 302.—ED.]

ANSWERS TO CORRESPONDENTS.

*** *Please address Chess Editor.*

John Simpson.—We have no hesitation in pronouncing your Problem to be a very fine composition, in which opinion we hope our readers will join.

Squire.—1. The fact of King having first move is not a detraction from the merits of a Problem. The action of the King being very limited, it is less likely that the idea will be discovered than if the first move has to be made by the Queen, as this lady is always first suspected with having evil designs on the hostile King, on account of her command of the board.

J. B. B.—Thanks for Problem, which, however, is too simple.

W. Mead, F. J. C., and Berrow.—Problems incorrect.

J. A. Miles.—Problems thankfully received. We mistook Eichhardt for "Eichstadt." Could you send us his four-mover, praised by Staunton, wherein a mate is obtained with Knight, after sacrifice of Queen? We should be much obliged for your kindness.

I. O. U.—There is an Elementary book of Problems by J. P. Taylor which contains fifty two-movers. You can get it at Morgan's.

P. P.—It is found by experience that the study of Problems does not much improve chess play, but it affords great pleasure. To play over games comprehensively annotated is more likely to improve play. You should try a little of both.

Correct solution received Problem No. 58:—T. T. Dorrington, W. R. Edwards (yes), G. W., F. W. Cooper, H. Jacobs, W. C. Thomas.

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